

Studies on the Accumulation of Chromium in Fenugreek

DS Xanthate, ChVR Murthy, SCS Rajan

and DMR Sekhar

Studying Cr uptake by Fenugreek we note that maximum concentration of Cr takes place in the shells of the pods followed by leaves, stems and seeds in that order. Interestingly, applied higher doses of Cr does not increase accumulation of Cr in the stems rather Cr content in the stems levels off. However, the maximum dispersal/distribution of Cr taken up is into the leaves.

Introduction

We have reported ^[1] the uptake and distribution of Cr into seeds and leaves of fenugreek (*Trigonella foenum-graecum*) under conditions of control as well as additional applied doses of Cr in the form of potassium dichromate to the soil during NaRMA – 2 Conference 2010, Udaipur. Here we are presenting the results of accumulation of Cr in the seeds, leaves, stems and the pod shells.

Soil Preparation

The lab scale field trials were conducted at Eshidiya phosphate mines, Jordan. The soil is highly saline ^[2] showing electrical conductivity around 15320 $\mu\text{S}/\text{cm}$ with a pH around 7.22. The soil was treated with PROM prepared with rock phosphate containing 24.48% P_2O_5 , in 80% passing through 79 microns size [PR (25/79)]. The ratio by weight of FYM to rock phosphate in the PROM was 4:1. Three plots of size 1 meter X 0.5 meters were prepared. Each plot was treated with 1.66 Kg of PROM which works out to 1632 Kg of P_2O_5 per Hectare. The P_2O_5 dose was advertantly kept high in view of high salinity of the soil and the impending toxicity of Chromium. It is important to note that P uptake by plants when rock phosphate is used in PROM is as required by the plants and hence the amazing residual effect of PROM.

Dichromate application

Thirty seeds of fenugreek per plot were sown in all the three plots. While first plot was not given potassium dichromate [treatment one, the control] the second [treatment two] and third [treatment three] plots were given two grams and four grams of potassium dichromate respectively as 1% solution in two doses with ten days gap at the time of flowering when the plants reached around ten centimetres height. The dichromate doses to the second and third plots work out to four grams per meter square or 40 Kg per hectare and eight grams per meter square or 80 Kg per hectare, respectively. Plants in the third plot with higher dose of potassium dichromate at 80 Kg per hectare appeared slow in growth after dichromate application whereas the application of dichromate at 40 Kg per hectare was normal as in control and no adverse effect could be observed in plants.

Table - 1

Accumulation of Chromium in Fenugreek

S.No	Chromium accumulation (%)	Control (No applied Cr)	Potassium Dichromate @ 40 kg/ha	Potassium Dichromate @ 80 kg/ha
1	Leaves	0.000445	0.00184	0.01105
2	Seeds	0.000085	0.00034	0.00043
3	Stems	0.00555	0.006205	0.0067
4	Pod shells	Not Analysed	0.009255	0.0302

Note: Cr content was analysed at the Department of Chemical Engineering, Andhra University, Vizag with AAS [Perkin El Mer (Model: AA200)] using air-acetylene flame.

Discussion and conclusions

Most of the heavy metals are toxic to the bio system. In spite of this these are absorbed and accumulated in their body parts ^[3-10] irrespective of their essentiality.

The accumulation of an element depends upon the inherent ability of the plant to absorb the particular element and its concentration in the substratum^[4]. In the present study it can be noted from the table - 1 that increase in the applied doses of Cr increased the concentration of Cr in pod shells, leaves and seeds whereas its

concentration in the stems is almost the same irrespective of an increase in the applied Cr dose. The increase in the Cr accumulation upon increase in applied dose by double is 107, 2% in the stems, 126.4% in the seeds, 326.3% in the pod shells and 600.4% in the leaves. We may note that most of the Cr accumulation takes place in the shell of pods and leaves. Obviously the quantity of leaves produced by the plant is more compared to the quantity of pod shells. Thus while the dispersal of taken up Cr is more in the leaves the concentration of Cr in the pod shells is high.

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